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FEEDING
COTTONSEED
PRODUCTS
TO LIVESTOCK



IN REGIONS where much corn, stover, fodder, timothy, or other carbohydrate feed is used, it is important to use some feed that is high in protein, such as cottonseed meal.

Cottonseed meal stimulates the appetite of fattening animals and causes them to consume more feed and likewise to make greater gains.

Cottonseed cake or meal may be used satisfactorily as a supplemental feed for fattening beef cattle on pasture.

Cottonseed meal is a very valuable protein feed for dairy cows. One pound of good-quality cottonseed meal furnishes as much digestible protein as 3 pounds of wheat bran. Like wheat bran, cottonseed meal is high in phosphorus.

For high-producing dairy cows, however, the addition of cottonseed meal to rations of the type mentioned renders them satisfactory only so far as the protein requirement is concerned.

Hogs may be fed cottonseed meal in limited quantities as a protein supplement.

Horses may be fed cottonseed products only in small quantities and then with great caution.

Procure prices on various grades of cottonseed meal or cake and choose the feed which supplies a pound of protein at the least cost.

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FEEDING COTTONSEED PRODUCTS TO LIVESTOCK

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CONTENTS

	Page	Page	
Value of cottonseed products as livestock feeds.....	1	Cottonseed products for various classes of livestock.....	5
Composition of cottonseed products.....	1	Cottonseed meal or cake for pasture feeding.....	11
Grades and classes of cottonseed products.....	2	Experimental results showing value of cottonseed products in rations.....	11
Economy of using high-grade cottonseed products.....	3		

VALUE OF COTTONSEED PRODUCTS AS LIVESTOCK FEEDS

COTTONSEED PRODUCTS have been used extensively for stock feeding in the South for many years. During more recent times their use has become general in many sections outside the Cotton Belt. The demand from foreign countries is strong, despite the fact that these products cost considerably more there than they do in this country. European feeders, as a rule, have placed more value on high-protein feeds than the average American livestock man.

Another reason why cottonseed products are of such great importance, in addition to their high protein content, is their immense production. Although the production of cotton has shown a slight decrease during the last 10 years, the decrease has not been so marked as has been the case with flaxseed, from which linseed meal¹ is made. Several new protein feeds, like peanut cake, copra cake, and fish meal, have been offered on the market during the last few years, but with the average stockman they have not been received with so much favor as cottonseed meal or linseed meal, due in part to their unknown value. These newer products, however, have some characteristics that are making them of value in livestock feeding.

COMPOSITION OF COTTONSEED PRODUCTS

There are a large number of cottonseed products used as livestock feeds. Both concentrates and roughages are included. All the concentrate products have the same general characteristics and qualities, their chemical composition depending mainly upon the form of manufacture and the thoroughness in separating out the hulls. Among the more common cottonseed products used as feeds are cot-

¹ This product is also known as "oil meal," and "new-process" and "old-process" meal.

tonseed, cottonseed meal and cake, and cottonseed hulls. Table 1 gives analyses representing these products, which have been put on the market by manufacturers to conform to the definitions adopted by the Association of Feed Control Officials of the United States.

TABLE 1.—*Composition of cottonseed products*¹

[Pounds of nutrients in 100 pounds]

Product	Water	Ash	Crude protein	Carbohydrates		Fat (ether extract)
				Fiber	Nitrogen-free extract	
	<i>Per cent</i>	<i>Per cent</i>				
Cottonseed	9.1	4.0	19.6	18.9	28.3	20.1
Cottonseed meal and cake:						
41 per cent protein	7.1	5.7	41.7	10.0	28.4	7.1
38.6 per cent protein	6.9	5.9	38.8	12.2	29.4	6.8
36 per cent protein	7.3	5.8	36.8	13.5	30.0	6.6
Cold-pressed cottonseed	6.9	4.2	27.5	24.2	30.2	7.0
Cottonseed hulls	8.7	2.6	3.5	46.2	38.0	1.0

¹ Furnished by the Bureau of Chemistry, United States Department of Agriculture.

GRADES AND CLASSES OF COTTONSEED PRODUCTS

Formerly cottonseed (uncrushed) was used quite extensively as a feed for livestock. Its value as a source of cottonseed oil and its utilization for commercial purposes has greatly decreased the amount fed in the form of seed. Cottonseed products have taken the place of the seed as a feedstuff. Several feeding tests have indicated that 1 pound of good-quality cottonseed meal is equal to nearly 2 pounds of cottonseed as a feed for fattening steers. Large rations of cottonseed tend to produce scours, but when used in quantities up to 5 or 6 pounds there is little or no trouble from this source.

Cottonseed contains about 20 per cent each of fat or oil and crude protein. Compared with a good grade of cottonseed meal it contains about half as much protein and about three times the content of oil.

A ton of cottonseed will yield approximately the following quantities of products:²

	Pounds
Linters or short fiber	110
Hulls	514
Cake or meal	954
Crude oil	303
Dirt and loss in manufacture	119
Total	2,000

Cottonseed cake is made from the residue which remains after the oil has been extracted from the seed. Ordinarily the greater part of the hulls is removed before the oil is extracted. When this is done the amount of crude fiber in the resulting cake is proportionately smaller. The hulled kernels are crushed, heated, and subjected to great pressure to remove the oil. The residue when of prime quality should be a hard, boardlike cake of a yellowish color. The color is often an indication of the quality. The presence of hulls

² Average for the five years 1914-15 to 1918-19 as compiled by the Bureau of Markets, United States Department of Agriculture, from Bureau of Census figures and estimates.

gives the cake a dark appearance. A dark color may also be caused by overheating during the pressing process or by fermentation, each of which lessens the feeding value.

Cottonseed cake and cottonseed meal are practically one and the same thing; that is, the meal is the cake in a ground form. The meal is most commonly used, but the cake has a distinct advantage in certain cases. European buyers show a preference for the cake for the reasons that there is less loss in handling, it is easier to judge the quality, and because the cake is better adapted for feeding alone or on the ground. Ocean freight rates also are lower for the cake than the meal.

In the United States the cake is preferred by men who feed their cattle in the open where the wind may blow the meal away. On the range or pasture the cake is often broken up and fed in troughs or spread upon the ground. If meal were used, the loss in feeding in this manner would be very large.

There are many grades and classes of cottonseed products sold on the market. The grades as classified and described by the Association of Feed Control Officials of the United States are as follows:

Cottonseed meal is a product of the cottonseed only, composed principally of the kernel with such portion of the hull as is necessary in the manufacture of oil, provided that nothing shall be recognized as cottonseed meal that does not conform to the foregoing definition and that does not contain at least 36 per cent of protein. Cottonseed meal shall be graded and classed as follows:

1. Cottonseed meal, prime quality. Cottonseed meal, prime quality, must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, yellowish, not brown or reddish, free from excessive lint, and shall contain not less than 36 per cent of protein. It shall be designated and sold according to its protein content. Cottonseed meal with 36 per cent of protein shall be termed "36 per cent protein cottonseed meal, prime quality," and higher grades similarly designated (as "43 per cent protein cottonseed meal, prime quality"), etc.

2. Cottonseed meal, off quality. Cottonseed meal not fulfilling the above requirements as to color, odor, and texture shall be graded "36 per cent protein cottonseed meal, off quality," and higher grades similarly designated.

Cottonseed feed is a mixture of cottonseed meal and cottonseed hulls, containing less than 36 per cent of protein.

Cold-pressed cottonseed is the product obtained from the subjection of the whole undecorticated cottonseed to the cold-pressure process for the extraction of oil and includes the entire cottonseed less the oil extracted.

Ground cold-pressed cottonseed is the product obtained by grinding cold-pressed cottonseed.

Cottonseed hulls are the roughage product of cottonseed-oil manufacture. The hulls are removed from the cottonseed before the oil is extracted. They have a very low-protein content and should be fed only in connection with protein-rich feeds. As a roughage the hulls have a lower feeding value than oat straw or corn stover, but are valuable where no other roughage is available. This product is used extensively in the South, especially for steer feeding.

Cottonseed-hull bran is ground cottonseed hulls from which the lint has been removed. The feeding value of the bran is not appreciably greater than that of ordinary cottonseed hulls.

ECONOMY OF USING HIGH-GRADE COTTONSEED PRODUCTS

Cottonseed products containing a high percentage of protein command relatively high prices, but judged from the cost of the protein contained, they are comparatively cheap. Some feeders prefer to buy the lower-grade products, believing them to be more economical

than the better grades. From the standpoint of the cost of the protein in the feeds such men are usually deceiving themselves. These products are usually purchased for their protein content and prices paid should be based on the protein contained in them. To show the value per pound of the protein in feeds at various prices and containing varying guaranteed analyses of protein, Table 2 has been prepared.

TABLE 2.—*Cost of protein per pound in feeds at various prices per ton*

Cost of feed per ton	Per cent of protein in feeds										
	12	16	20	24	28	32	36	38	41	43	45
Cost per pound of protein											
\$25.00	10.42	7.82	6.25	5.23	4.47	3.91	3.47	3.29	3.05	2.91	2.77
30.00	12.50	9.38	7.50	6.25	5.36	4.69	4.16	3.95	3.66	3.48	3.38
35.00	14.58	10.94	8.75	7.29	6.25	5.47	4.86	4.61	4.26	4.07	3.89
40.00	16.67	12.50	10.00	8.33	7.14	6.25	5.55	5.26	4.88	4.65	4.44
45.00	18.75	14.06	11.25	9.38	8.03	7.03	6.25	5.92	5.49	5.23	5.00
50.00	20.83	15.63	12.50	10.42	8.93	7.81	6.94	6.58	6.09	5.81	5.55
55.00	22.91	17.19	13.75	11.46	9.82	8.59	7.64	7.24	6.71	6.40	6.11
60.00	25.00	18.75	15.00	12.50	10.71	9.38	8.33	7.89	7.32	6.97	6.67
65.00	27.08	20.31	16.25	13.54	11.67	10.16	9.03	8.55	7.92	7.56	7.22
70.00	29.16	21.87	17.50	14.58	12.50	10.94	9.72	9.21	8.53	8.14	7.78
75.00	31.25	23.44	18.75	15.62	13.39	11.72	10.41	9.87	9.14	8.72	8.33
80.00	33.33	25.00	20.00	16.67	14.28	12.50	11.11	10.53	9.75	9.32	8.89
85.00	35.41	26.56	21.25	17.71	15.18	13.28	11.80	11.18	10.36	9.88	9.44
90.00	37.50	28.12	22.50	18.75	16.07	14.06	12.50	11.84	10.97	10.48	10.00
95.00	39.58	29.69	23.75	19.79	16.43	14.84	13.19	12.50	11.58	11.04	10.55
100.00	41.67	31.25	25.00	20.83	17.86	15.62	13.89	13.16	12.19	11.63	11.11

The poorer grades of cottonseed meal or cake usually sell only a little lower than the prices for the higher-grade products. By obtaining commercial prices on both high-grade and low-grade products and referring to Table 2, one can ascertain approximately which feed will provide protein at the least cost. It must be remembered, however, that the feeding values of different feeds having essentially the same coefficients of digestibility are not exactly proportional to their respective protein contents. A low-protein feed usually has a higher content of carbohydrates, which may partially make up in feeding value for the difference in protein content.

Good cottonseed meal contains three times as much digestible protein and as much digestible carbohydrates and fat combined as there is in wheat bran. One pound of cottonseed meal will balance as much corn as 3 pounds of bran.

Sometimes the analysis of cottonseed meal offered for sale is given on the tag in terms of nitrogen or of ammonia, or it may be quoted in those terms by feed dealers. One may readily determine the protein content by using the following factors:

Multiply the nitrogen by 6.25. For example, if the analysis is given as 6 per cent nitrogen, then the pounds of protein in 100 pounds of the meal will be 6×6.25 , which is 37.50. This means that it is a good grade of meal.

If the analysis is given in terms of ammonia, multiply the per cent of ammonia by 5.15. For example, if the analysis is given as 7.5 per cent ammonia, the protein in 100 pounds of the meal will be 7.5×5.15 , which is 38.62, meaning that it is a good grade of meal.

COTTONSEED PRODUCTS FOR VARIOUS CLASSES OF LIVESTOCK

The rations given in the succeeding pages may be used as the average and may be adjusted to suit local conditions. If the suggested rations can not be used, one may substitute other feeds of the same general character as those included in the rations outlined. These rations are primarily designed to show the proper proportions in which to use cottonseed products and no attempt is made to cover all conditions.

In discussions of feeding cottonseed products, the quantities for the different classes of animals are given in pounds. While it is important to weigh the meal as fed, yet it may be entirely satisfactory merely to weigh at frequent intervals the contents of a certain measure or vessel. Table 3, giving weights and measures, may be helpful along this line.

TABLE 3.—*Equivalent weights and measures of cottonseed products*

Product	1 quart weighs—		1 pound measures—
	Pounds	Quarts	
Cottonseed.....	0.8	1.3	
Cottonseed meal.....	1.5	.7	
Cottonseed hulls.....	.3	3.3	

FATTENING CATTLE

It is for fattening cattle that cottonseed concentrates serve their greatest usefulness. A very large percentage of cottonseed feeds is used for cattle fattened for market. The usual feeding period for this class of cattle is from 90 to 120 days, and during that period comparatively large quantities of cottonseed cake or meal are used. When steers are not fed more than 7 pounds of cottonseed meal a day, they can usually be fed from 100 to 120 days without showing any signs of cottonseed-meal poisoning. If silage or other succulent feed is given as roughage, the meal can be fed longer without harmful results.

When cattle are fed a ration composed only of cottonseed hulls and meal, they usually make good daily gains for the first 60 days, after which the gains diminish rapidly, and after 90 to 100 days they are seldom satisfactory. For a short feeding period cottonseed hulls and meal give satisfactory results. If the roughage is silage instead of hulls, the daily gains are more nearly uniform throughout the feeding period, and if care is used in feeding the meal it can be fed for 150 days without ill effects.

In many of the leading cattle-feeding sections of the Corn Belt cottonseed meal is used extensively, especially as a supplement to silage. (Fig. 1.) Where alfalfa is grown successfully, as in the western part of the Corn Belt, little or no cottonseed meal is used. Not only has it proved to be economical for fattening cattle in the winter, but many feeders use the cake as a supplement to grass. Its use in most feeding sections is limited to 3 or 4 pounds a day for cattle averaging 1,000 pounds live weight.

One reason why cottonseed meal is highly prized for feeding cattle is that it puts on a glossy finish, which makes them sell better than

cattle having harsh, rough coats. There is also a tendency for cattle receiving cottonseed meal to put on a smooth, even covering of firm flesh.

Suggested rations for fattening steers averaging 1,000 pounds in weight

RATION 1		Pounds	RATION 3		Pounds
Corn (or sorgo) silage	25		Sorgo (or kasfir) silage	35	
Mixed hay	10		Grass hay or stover	6	
Corn	10		Cottonseed meal or cake	4	
Cottonseed meal	3		Kafir (or milo) chops	10	
RATION 2			RATION 4		
Wet beet pulp	80		Sorgo silage	30	
Prairie hay	10		Grass hay or stover	6	
Beet molasses	4		Velvet beans in pod	6	
Cottonseed meal	4		Cottonseed meal	3	

STOCK CATTLE

For stock cattle the use of cottonseed meal is ordinarily confined to the winter period, and then only in amounts sufficient to add to

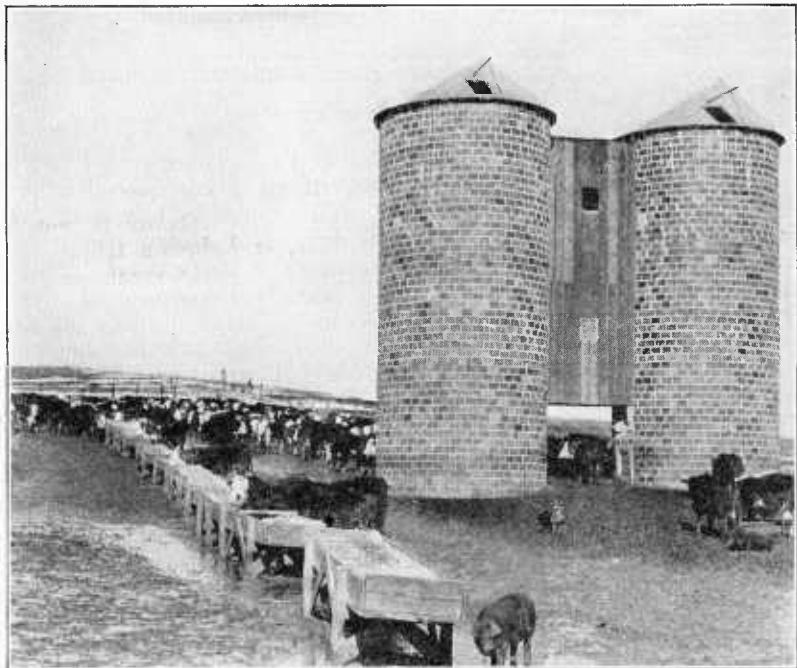


FIG. 1.—Cottonseed meal and corn silage make a good feed combination for beef cattle. The meal supplies the protein which the silage lacks

the ration the protein required. It is especially valuable to use in connection with cheap roughages and silages which are highly carbonaceous feeds. For stock cattle weighing 500 to 750 pounds, from 1 to 2 pounds of the meal is enough to balance properly most roughage rations. When legume hays are used the cottonseed meal may

be materially reduced and sometimes entirely eliminated to advantage. If alfalfa or clover constitutes half or more of the roughage ration, there is little or no need for the use of additional protein-rich feeds.

Few combinations are more economical than a ration of corn silage and cottonseed meal for wintering stock cattle. One to two pounds of cottonseed meal combined with whatever silage stock steers will eat should keep them in good, thrifty condition and cause them to make a satisfactory gain. The cost of wintering such cattle can usually be lessened by permitting the steers to run in the stalk fields and giving them feed at night only. Straw and other roughages which can not be used to advantage in any other way may be fed with silage and cottonseed meal.

Suggested rations for wintering stockers averaging 750 pounds in weight

RATION 1		Pounds	RATION 3		Pounds
Corn (or sorgo) silage-----		25	Corn-stover silage-----		25
Oats or wheat straw-----	Unlimited.		Grass hay-----		6
Cottonseed meal-----	$\frac{1}{2}$ to $1\frac{1}{2}$		Cottonseed meal-----		$\frac{1}{2}$ to $1\frac{1}{2}$
RATION 2		RATION 4			
Corn (or sorgo) silage-----	25	Cottonseed cake-----		1 to $1\frac{1}{2}$	
Oats or corn-----	2	Silage, to supplement winter		15 to 20	
Cottonseed meal-----	$\frac{1}{2}$	pastures-----			
Straw or stover-----	Unlimited.				

BREEDING CATTLE

In feeding cottonseed meal to beef cows, two classifications may be made—dry cows and cows that nurse calves. The dry cows may be handled in much the same manner as stock cattle. The amount of cottonseed meal that should be fed to this class of cows depends on the other feeds used. Some feeders use excessive quantities of cottonseed meal, causing the cost of the ration to become uneconomically high. From 1 to $1\frac{1}{2}$ pounds of cottonseed meal may be fed daily with other feeds, such as corn silage and good hay. Where corn silage is available, a good ration for breeding cows would be 25 to 30 pounds silage, from 1 to $1\frac{1}{2}$ pounds cottonseed meal or cake, and other roughage, such as stalk fields, corn stover, hay, or straw.

Cows that are nursing calves should receive more protein supplements than dry cows, but the amounts fed should not be greater than is necessary to balance properly the other feeds, which may consist largely of roughages. Ordinarily beef cows raising calves are fed not more than 2 pounds each daily, and then only during the winter period.

Suggested rations for wintering beef-breeding cows averaging 1,000 pounds in weight

RATION 1		Pounds	RATION 3		Pounds
Corn silage-----		25 to 30	Grass hay or stover-----		18 to 20
Cereal straw or stover-----	Unlimited.		Cottonseed meal or cake-----		$1\frac{1}{2}$ to 2
Cottonseed meal-----	1 to $1\frac{1}{2}$				
RATION 2		RATION 4			
Corn (or sorgo) silage-----	25 to 30	Kafir (or milo) silage-----		30 to 35	
Cottonseed meal-----	1 to $1\frac{1}{2}$	Kafir or milo stover or ce-		Unlimited.	
Winter pasture.		real straw-----			
		Cottonseed meal or cake-----			

DAIRY COWS

Dairy cows are often fed comparatively large quantities of cottonseed products, sometimes for long periods of time. Cottonseed meal is a valuable supplement to dairy rations which are complete in every respect except their protein content. The special value of cottonseed meal depends on its protein content. The amount of it to use should be regulated partly by the production of butterfat and the nature of the other feeds used.

One must remember also that cottonseed meal or cake is constipating and should be used with more laxative feeds, such as linseed meal, wheat bran, silage, or roots. When used in large quantities for dairy cows it produces hard, tallowy butter, light in color and poor in flavor. When used in moderate amounts the quality of the products need not be impaired and in many instances can be improved if the other feeds tend to produce soft butter. The cottonseed products are heavy, concentrated protein feeds and for best results should be used with lighter and more bulky feeds. For average dairy cows the quantity of cottonseed meal should be limited to 25 per cent of the grain mixture and in no case should exceed 4 pounds a day. All dairy rations should contain, if possible, some good-quality legume hay or legume pasture, especially in the case of high-producing cows.

Suggested rations for a 1,000-pound dairy cow, giving 25 pounds of 4 per cent milk daily

RATION 1		RATION 3	
	Pounds		Pounds
Clover hay	10	Barley (or oat) hay	15
Corn (or sorgo) silage	35	Clover or alfalfa hay	5
Ground corn	3	Dried beet pulp (soaked)	6
Wheat bran	2	Cottonseed meal	3
Cottonseed meal	2		

RATION 2		RATION 4	
	Pounds		Pounds
Roots (mangels)	40	Corn (or sorgo) silage	35
Mixed hay	15	Grass hay	10
Corn-and-cob meal	2	Corn chops	4
Crushed barley	3	Cottonseed meal	3
Cottonseed meal	2½		

BULLS AND YOUNG STOCK

Bulls should receive a liberal quantity of protein-rich feeds. Cottonseed meal or cake may be used for the bull to the extent of from 2 to 4 pounds, with other concentrates, such as bran, corn, and oats.

It is highly important that young stock of both beef and dairy breeds intended for breeding purposes be supplied with an abundance of protein and mineral matter. However, it may not be advisable to feed calves up to 6 months of age more than one-half pound per head per day. Calves at 1 year of age may be fed up to 2½ pounds.

HOGS

Cottonseed meal may be fed safely to hogs to the extent of 12 per cent of the total ration. The most economical method of feeding it, however, is to mix it with tankage, linseed meal, or alfalfa meal, and then not to exceed 50 per cent of such mixture.

Before the use of cottonseed meal became general, cattle feeders believed that hogs following the steers in the feed lot might become poisoned. Experience has shown, however, that no detrimental results follow this practice. Evidently the toxic substances have become neutralized in the process of digestion. When the meal or cake fed to the cattle is not accessible to the pigs, there is no danger that the pigs will be poisoned by eating the waste feed in the droppings.

HORSES

The use of cottonseed meal for horses and mules is recommended only in limited quantities, and then care must be exercised in securing cottonseed meal of good quality.

Cottonseed meal has met with considerable disfavor among horse feeders because they say it causes digestive disorders. There may be considerable truth in this statement, because many horses have been killed by the feeding of excessive quantities of cottonseed meal. In too many cases, however, the quality has not always been the best or the quantity safeguarded. Horses are very susceptible to injury from eating moldy feed and this applies particularly to the use of cottonseed products. In the South, plantation owners often feed their mules on cottonseed meal in conjunction with corn with apparently good results. Often it is used in connection with black-strap molasses and grain.

The meal should be given to horses gradually at first and it should always be used as a supplement to a carbonaceous feed, such as corn. The meal is not relished by horses and, being unpalatable, it should be well incorporated with other feeds. While it has been fed in larger quantities in a few cases, the best results may be obtained by limiting the amount to 1 pound per 1,000 pounds live weight and by giving special attention to the horses receiving the cottonseed meal.

Suggested rations for a 1,000-pound horse at medium work

RATION 1		RATION 3	
	Pounds		Pounds
Oats	12	Rolled barley	10
Timothy hay	12	Oat hay	12
Cottonseed meal	¾	Cottonseed meal	1
RATION 2		RATION 4	
Shelled corn (dent)	8	Shelled corn (dent)	9
Wheat bran	4	Molasses (cane)	2
Mixed timothy and clover hay	10	Cowpea hay	6
Cottonseed meal	¾	Sorgo fodder	6
		Cottonseed meal	1

SHEEP

In feeding sheep it is highly important to balance properly the rations used. Protein-rich concentrates can be used advantageously for this purpose. (Fig. 2.) Cottonseed meal and cake have been used for fattening sheep with fairly satisfactory results. In limited quantities they may be used advantageously.

Cottonseed meal and cake are also used to advantage in limited quantities for breeding ewes. One-half pound a day meets their requirements.

Sheep should be started on cottonseed products in small quantities. Lambs when on full feed should receive not more than one-third of a pound a day when fed no other concentrates, and only one-eighth to one-fourth of a pound in combination with other grains. It is advis-



FIG. 2.—Best carload of grade lambs from range ewes at the 1925 International Livestock Exposition. Fed and exhibited by Purdue University Agricultural Experiment Station. These lambs received a ration consisting, by weight, of seven parts of corn and one part of cottonseed meal fed with corn silage and clover hay.

able to use cottonseed meal in connection with corn, oats, or similar grain. Sheep usually relish cottonseed cake more than the finely ground meal.

Suggested rations for 60-pound fattening lambs

RATION 1		RATION 3	
	Pounds		Pounds
Shelled corn	1.0	Corn silage	1.2
Grass hay	1.0	Barley	1.0
Cottonseed meal	.25	Cottonseed meal	.2
		Clover hay	.6

RATION 2		RATION 4	
	Pounds		Pounds
Shelled corn	1.2	Barley	.6
Alfalfa	.4	Wet beet pulp	3.0
Corn silage	.6	Cottonseed meal	.25
Cottonseed meal	.2	Prairie hay	1.0

POULTRY

Cottonseed meal is a fair poultry feed and may often be used economically in poultry rations in sections where it is produced. Vegetable protein feeds do not give as good results with poultry as animal-protein feeds and should always be supplemented with animal proteins as well as with minerals. The following mash for laying hens contains cottonseed meal supplemented with meat scraps and minerals:

	Pounds		Pounds
Yellow corn meal	35	Alfalfa leaf meal	5
Middlings	20	Bone meal	5
Cottonseed meal	10	Ground limestone	2
Meat scraps	12	Salt	1
Bran	10		

This mash should be fed with a good scratch ration which may be made up of the following ingredients, by weight: 2 parts yellow corn, 1 part wheat, and 1 part oats, or 2 parts corn and 1 part wheat.

COTTONSEED MEAL OR CAKE FOR PASTURE FEEDING

For years feeders, of the Southwest particularly, have used 1 to 2 pounds of cottonseed cake for feeding cows and steers on range in the fall and winter. Somewhat more cottonseed cake or some roughage as suggested on pages 6 and 7 should be fed when the grass is covered with snow and also during periods of grass shortage. The fattening of cattle on grass with cottonseed cake during the spring and summer months has during more recent years been found to be an economical practice. The cake is usually preferred to the meal for grass feeding. In regard to feeding cake in preference to meal, a former publication of the bureau is here quoted.³

There are several advantages in feeding cake in place of meal, especially in summer feeding. A rain does not render the cake unpalatable, but it will often put the meal in such a condition that the cattle will not eat it. Again, no loss is incurred with the cake during windy days, whereas the meal, when fed in the open pasture, is sometimes wasted on account of the high winds. Furthermore, the cake requires chewing before being swallowed and therefore must be eaten very much slower than the meal, so when a number of steers are being fed together the greedy one has little chance to get enough cake to produce scours. When cottonseed meal is fed, the greedy steer often scours, because he can bolt the meal and get more than his share; this not only injures the steer but makes the bunch "feed out" unevenly.

In experiments conducted in the Southeast by the Bureau of Animal Industry in which the cake was fed in troughs in the pasture, it was found after several years' work that the feeding of cottonseed cake to cattle on pasture caused the cattle to fatten more rapidly, to develop greater finish, and to make greater profits in most cases than with similar cattle which received pasture alone. The value of the cake as a supplement to pasture, of course, depends to a considerable extent upon the nature of the pasture grasses, its use for legumes not being so profitable as with true grasses. As a rule, however, the feeding of cottonseed cake on good grass pasture is not highly profitable. The stage of maturity of the grass is also of significance in this connection, because dry, mature grass is of a more carbonaceous nature than grass in earlier stages of growth.

EXPERIMENTAL RESULTS SHOWING THE VALUE OF COTTONSEED PRODUCTS IN RATIONS

VALUE OF PROTEIN SUPPLEMENT FOR STEER FEEDING

Numerous experiments have conclusively shown the value of protein supplements when added to rations deficient in protein. The following summary covers four experiments, averaging 132

³ GRAY, DAN T., and WARD, W. F. BEEF PRODUCTION IN ALABAMA. Bur. An. Ind. Bull. 131, 47 p., illus., 1911.

days, with 2-year-old steers, in which a nitrogenous supplement was added to a ration of corn and a carbonaceous roughage.

The addition of the protein supplement increased the average daily gain 0.6 pound a day and reduced the total concentrates required to produce 100 pounds gain from 1,082 pounds to 862 pounds and the roughage from 522 pounds to 402 pounds.

TABLE 4.—*Summary of four feeding experiments showing the value of a protein supplement*¹

Ration	Number of steers	Average daily gain	Feed per 100 pounds gain		
			Concentrates		Carbo- naceous roughage
			Corn	Protein supple- ment	
Corn and carbonaceous roughage.....	44	Pounds 1.60	Pounds 1,082	-----	Pounds 522
Corn, protein supplement, and carbonaceous roughage.....	54	2.20	766	96	402

¹ Bulletin references: Ill. Expt. Sta. Bull. 83; Ind. Expt. Sta. Bull. 115; Nebr. Expt. Sta. Bull. 90 and 93.

COTTONSEED MEAL COMPARED WITH OTHER CONCENTRATES FOR DAIRY COWS

Many experiment stations have fed cottonseed meal to dairy cows in order to compare it with other protein feeds. A condensed statement of the results obtained is shown in Table 5.

TABLE 5.—*Results of feeding experiments showing relative value of cottonseed meal and other concentrates*

Station	Feed with which compared	Result
Florida.....	Velvet beans in pod.....	Cottonseed meal worth from 1.5 to 2.5 times as much.
Maine.....	Gluten meal.....	Cottonseed meal superior.
Massachusetts.....	do.....	Do.
Do.....	Ground soy beans.....	Practically the same.
Mississippi.....	Cottonseed.....	Cottonseed meal superior.
Do.....	do.....	1 pound cottonseed meal is equal to 1.71 pounds cottonseed.
Do.....	Velvet beans in pod.....	3 pounds velvet beans superior to 2 pounds cottonseed meal.
New Jersey.....	Equal parts wheat bran and dried brewers' grains.....	4.5 pounds cottonseed meal are practically equal to 10 pounds of the other feeds.
Do.....	Ground soy beans.....	Practically the same.
Pennsylvania.....	Wheat bran.....	Cottonseed meal increased yield about 20 per cent.
South Carolina.....	Velvet-bean meal.....	Cottonseed meal slightly superior.
Do.....	Wheat bran.....	1.5 pounds cottonseed meal slightly superior to 3 pounds wheat bran.
Tennessee.....	Ground soy beans.....	Practically the same.
United States Department of Agriculture.....	Fish meal.....	1 pound fish meal is equal to 1.24 pounds cottonseed meal.
Do.....	Peanut feed.....	1 pound cottonseed meal is equal to 1.36 pounds peanut feed.
Do.....	Velvet-bean meal.....	1 pound cottonseed meal is equal to 1.54 pounds velvet-bean meal.

Cottonseed meal is higher in protein than any other feed with which a comparison was made with the exception of fish meal. It will be noted in Table 5 that in no case did a feed containing a smaller

percentage of protein than the cottonseed meal prove better than cottonseed meal. In this comparison the only feed showing results superior to those obtained from cottonseed meal was fish meal.

PASTURE SUPPLEMENTED WITH COTTONSEED CAKE

TABLE 6.—*Value of cottonseed products as a supplement to pasture in steer feeding*¹

Lot	Ration	Average daily gain		Daily ration of concentrates	Selling price of cattle	Profit per steer
		Pounds	Pounds			
Lot A -----	Pasture alone -----	1.52			\$3.66	\$2.86
Lot B -----	Pasture plus cottonseed cake -----	2.32	3.31		4.53	10.42

¹ From Bureau of Animal Industry Bulletin 131.

The addition of 3.31 pounds of cottonseed cake a day as a supplement to the grass increased the daily gain 0.80 pound, or from 1.52 to 2.32 pounds. The use of the protein supplement increased the selling prices of the cake-fed cattle, so that they made a much greater profit than the cattle receiving grass alone.

COTTONSEED MEAL AS A SUPPLEMENT TO CORN AND A CARBONACEOUS ROUGHAGE FOR FATTENING LAMBS

In Table 7 the results of four experiments, averaging 80 days, show the effect of adding cottonseed or linseed meal to a ration of timothy hay and corn.

TABLE 7.—*Effect of cottonseed meal or linseed meal as a supplement to timothy hay and corn for lambs*¹

Ration	Daily gain	Feed for 100 pounds gain	
		Concentrates	Hay
Corn -----	Pounds	Pounds	Pounds
Timothy hay -----	1.2	0.23	520
Corn -----	1.0		448
Timothy hay -----	1.2		
Cottonseed (or linseed) meal -----	1.0	.30	463
	.2		334

¹ From Ohio Exp. Sta. Bull. 245, Minn. Exp. Sta. Bull. 31, and Ind. Exp. Station Bull. 162.

The use of a small quantity of protein-rich concentrate increased the daily gains 30 per cent and made a saving of 57 pounds of concentrates and 114 pounds of roughage per 100 pounds gain.

LINSEED MEAL AND COTTONSEED MEAL FOR FATTENING SHEEP

TABLE 8.—*Summaries of sheep-fattening experiments showing comparative value of linseed meal and cottonseed meal¹*

Ration	Initial weight	Daily gain	Feed for 100 pounds gain	
			Concen- trates	Hay
Ohio station, 112-day trial:				
Lot 1. 40 lambs—				
Linseed meal	0.2			
Shelled corn	1.0			
Clover or alfalfa hay	1.5			
			65	0.30
Lot 2. 40 lambs—				
Cottonseed meal	0.2			
Shelled corn	1.0			
Clover or alfalfa hay	1.5			
			67	.31
Missouri station, 98-day trial:				
Lot 1. 20 yearling wethers—				
Linseed meal	0.2			
Shelled corn	1.1			
Clover hay	1.8			
			79	.25
Lot 2. 20 yearling wethers—				
Cottonseed meal	0.2			
Shelled corn	1.1			
Clover hay	1.8			
			78	.24

¹ From Ohio Expt. Sta. Bull. 179 and Mo. Expt. Sta. Bull. 115.

In the trials listed in Table 8 cottonseed meal and linseed meal showed substantially the same value for balancing the rations of fattening lambs and wethers. Whether to use cottonseed or linseed meal as a protein supplement for fattening sheep depends to a very large extent upon their relative prices and availability.

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